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A PLOTTING PROGRAM FOR THE DATATRON 220.(U)
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NEL / Technical Memorandum 426

A PLOTTING PROGRAM FOR THE DATATRON 220

by

Willie P. de la Houssaye

INTRODUCTION:

When reducing data or doing computations on a computer, it is often desired to see what the results will look like when plotted. This has required either tabulation of the data followed by hand plotting, or punching cards and then using the small X-Y plotter to plot the cards. With the program presented here, data can be directly plotted from the computer without any intermediate steps, and at a faster speed than is possible by either of the above methods.

The result of this program is an X-Y plot on the IBM 407 page printer. The y values can have any range, and the increment of y can be selected, with the provision that each y value will take a line of print on the 407. The plotting is exact in that a point will be plotted only if its value is exactly that of the y value of that line. The program will plot from 21 to 120 points per graph, and will proceed to a new graph until all the points have been plotted.

The program may also be used as a subroutine with another program, where the other program may scale the data, find and set the limits on y, etc.

This program will not take a random arrangement of x values. The data in memory of the computer must be the y values for a sequential set of x values, such as would be in a time series, where the levels would be taken every minute, hour, or at any fixed interval.

407 PLOTTING:

This program will take data from memory of the Burroughs 220 computer and plot it directly on the IBM 407 page printer. This data must be in sequential order of x values, i.e., the first cell is the value of y for $x[1]$, the second, the y value for $x[2]$, etc. These numbers can be in either floating or fixed point. If they are in floating point, the program will convert them to fixed point and round them to whole numbers; if they are fixed, the decimal should be in the fifth place (i.e. $\pm 1234\ 5.0\ 0000$) and the numbers rounded to whole numbers. The program compares the sign and the first five digits of the number with the y value. The method of setting the constants is shown in the section on Ranges, and modifications for plotting to tenths can be made as shown in the Modifications section.

Also, the program can plot two curves simultaneously, the first curve being given preference over the second if the two have the same y value at a point. The first curve is plotted with "." as the points, and the second curve with "*" ; thus, if the two have a common point, only one y value will show for that value of x , and it will be a "." . Any number of points from 21 to 120 per graph may be plotted, with the end point repeated if desired, as would be done in a calendar plot where one would plot from midnight to midnight on a graph and would want the same midnight to begin the next graph.

The y values may be listed down the left hand column, if desired, and the graph can be separated from the y values if the number of points per graph is less than 116, with the use of program switches.

When plotting a long list of data, the number of lines per graph should be the same as the number of lines the 407 prints per page or a submultiple thereof, which is normally 58. Thus, with a y range of 29 lines (10-38, with a y increment of 1, for example) there will be two full graphs on a page. This lets the 407 skip to a new page for a new graph. However, each time the program is started, it will automatically advance the 407 to a new page.

The program will not plot zeroes whose sign is the same as the sign of the y increment.

A listing of the program follows the figures of this memo.

PROGRAM INFORMATION:

Input:

The program may be floated into any location of memory from cards by setting the B register to the desired location and using the service routine of S. W. and C. B. Porter (NEL Technical Memo 341) to load the cards. From paper tape, set B to the desired location and read in the tape to that location. The program is 300 words long and occupies relative locations 0000 - 0299.

There is no provision for loading data in the program. Data may be stored in the computer by any means; cards, paper tape, magnetic tape, or computed and stored by another program. This permits flexibility and does not limit the input of data to one form or another. For plotting it is only necessary to know where the data starts in memory and how many words there are.

ACCESSION For	
NTIS	Write Section <input checked="" type="checkbox"/>
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JUSTIFICATION	<i>for the</i>
<i>on file</i>	
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<i>A</i>	

Program Switches:

- No. 1 - ON for plotting two sets of data simultaneously
- No. 2 - ON if LLL (see Register Settings) points are to be plotted on each graph
OFF for 120 points
- No. 3 - ON for repeat of end point (effective only if switch no. 2 is on -- that is, if 120 points per graph are to be plotted with repetition, set switches 2 and 3 on and set LLL equal to 120).
- No. 4 - ON for listing the y values.
- No. 7 - ON for separating y values from plot (only if LLL is less than 116, See Figs. 2 and 3).
- No. 9 - ON if set 2 is in fixed point
- No. 0 - ON if set 1 is in fixed point

NOTE: Once a set has been plotted, it is in fixed point and is no longer available in floating point in the computer.

Register Settings:

rA = 0 nnnn 00 aaaa

rR = 0 LLLO 00 bbbb

rP = relative 0000

where: nnnn is the number of points to be plotted

aaaa is the location in memory where data set 1 starts

bbbb is the location in memory where data set 2 starts, if any

LLL is the number of points to be plotted per graph
(21 ≤ LLL ≤ 120)

NOTE: For one set of data and 120 points per graph the R register need not be set.

Ranges:

The range of y is in cells 0150-0152, as in the following

examples:

TO PLOT:

<u>Cell</u>	<u>Quantity:</u>	<u>10 to 38</u>	<u>-20 to 30</u>
0150	max y	0 0003 80 0000	0 0003 00 0000
0151	increment	1 0000 10 0000	1 0000 10 0000
0152	min y	0 0000 90 0000	1 0002 10 0000

The value in cell 0152 is the min y to be plotted plus the increment. Also, the increment may be any value, such as 2, 5, etc.

Grids:

Vertical grids can be included on the plots by proper coding of locations 0220 through 0243. Each of these words represents five print locations on the 407 (the sign digit is not used); thus, if vertical grids, using I's, as in Fig. 1, would be desired every ten print locations on the 407, words 0220, 0222, 0224, 0226, etc., would be 0 4900 00 0000, where the 49 is the coding for I.

If no grids are desired, clear locations 0220 through 0243. Following is an example for the system that would be used for hourly data plots with grids every twelve points, where the XX are for midnights and the YY are for noons:

0220	0 XX00 00 0000
	0 0000 00 0000
	0 0000 YY 0000
	0 0000 00 0000
	0 0000 00 00XX
0225	0 0000 00 0000
	0 0000 00 0000
	0 00YY 00 0000
	0 0000 00 0000
	0 0000 00 XX00
0230	0 0000 00 0000
	0 0000 00 0000
	0 YY00 00 0000
	0 0000 00 0000
	0 0000 XX 0000
0235	0 0000 00 0000
	0 0000 00 00YY
	0 0000 00 0000
	0 0000 00 0000
	0 00XX 00 0000
0240	0 0000 00 0000
	0 0000 00 YY00
	0 0000 00 0000
	0 0000 00 0000

If M s are desired at midnight and N s for noon, as is shown in Fig. 2, put XX = 54 and YY = 55.

Modifications:

For plotting to tenths, make the following program changes, which are available on cards:

0015	0 0001 48 0004
0032	0 0001 48 0004
0191	0 8080 03 8000
0245	8 0000 10 0148
	0 0000 48 0003
	8 8110 40 0191
	0 0000 49 0003
	8 4110 40 0191
0250	0 0000 49 0001
	8 2110 40 0191
	8 7000 38 0076
	8 0000 10 0191
	8 0000 40 0192
0255	8 0000 30 0076

If original data is in fixed point, place the decimal at the fourth place (i.e., ± 1234.50000).

No data changes are necessary for floating point data.

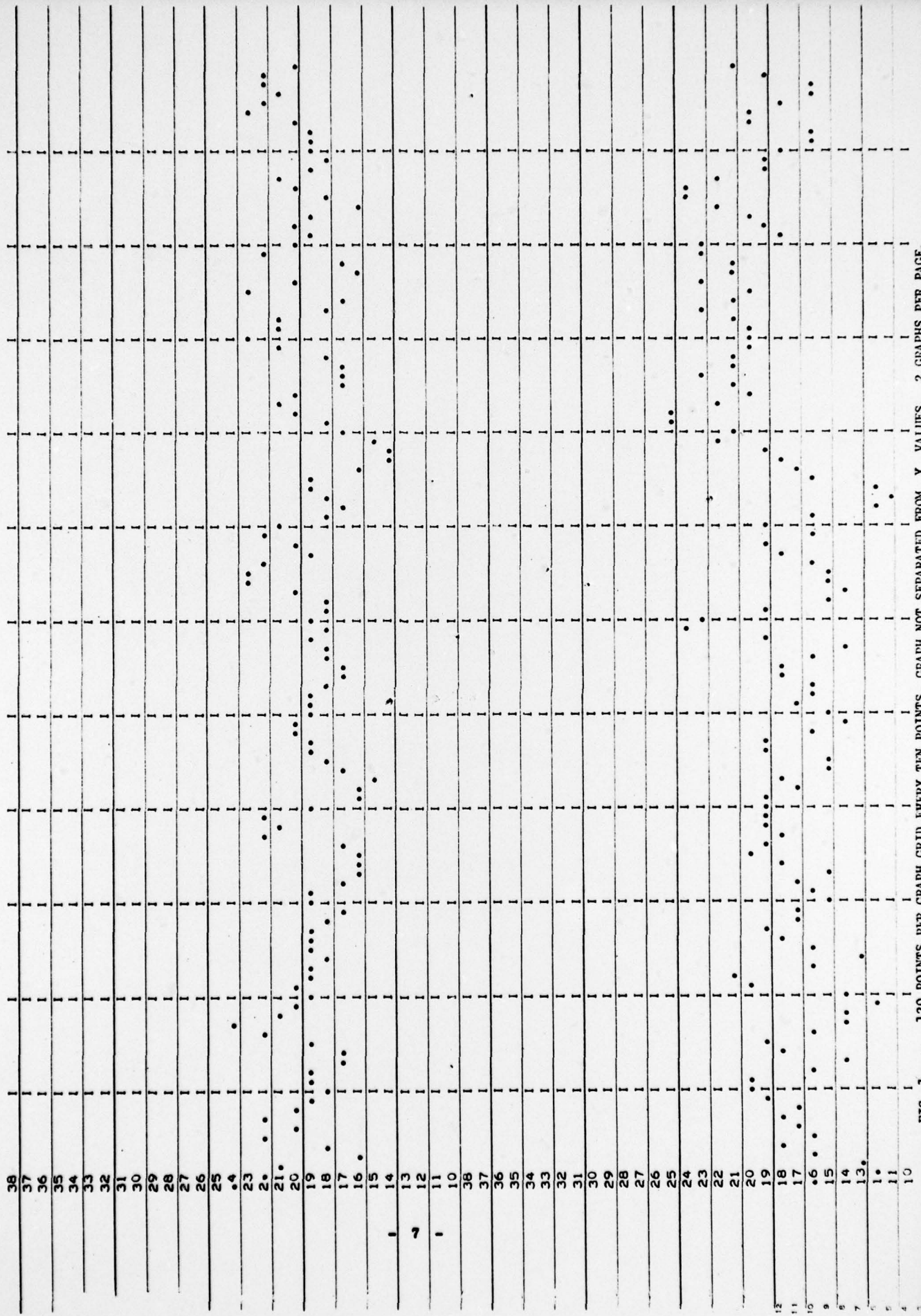


FIG. 1 - 120 POINTS PER GRAPH, GRID EVERY TEN POINTS, GRAPH NOT SEPARATED FROM Y VALUES. 2 GRAPHS PER PAGE.

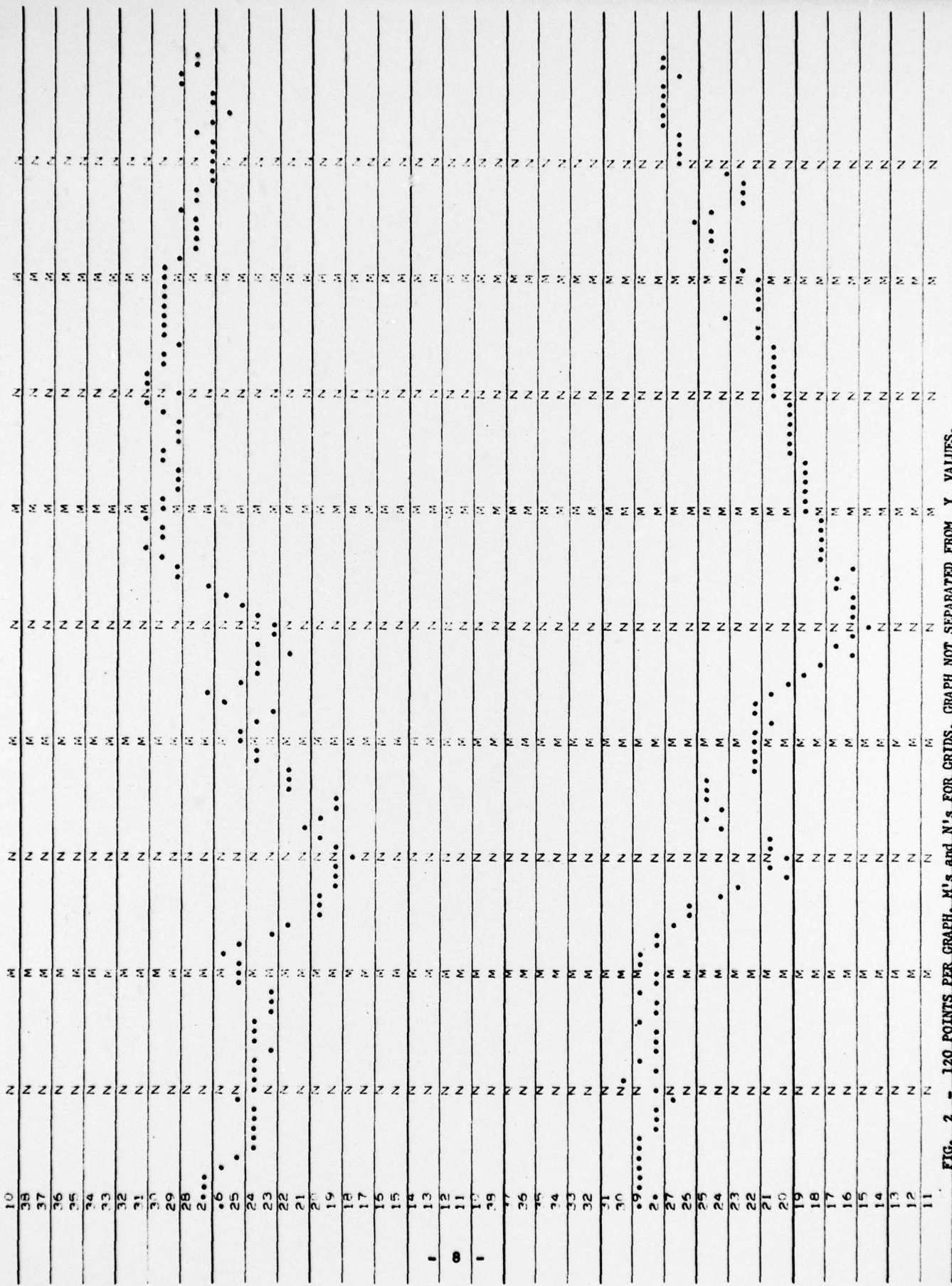


FIG. 2 - 120 POINTS PER GRAPH, M's and N's FOR GRIDS, GRAPH NOT SEPARATED FROM Y VALUES.

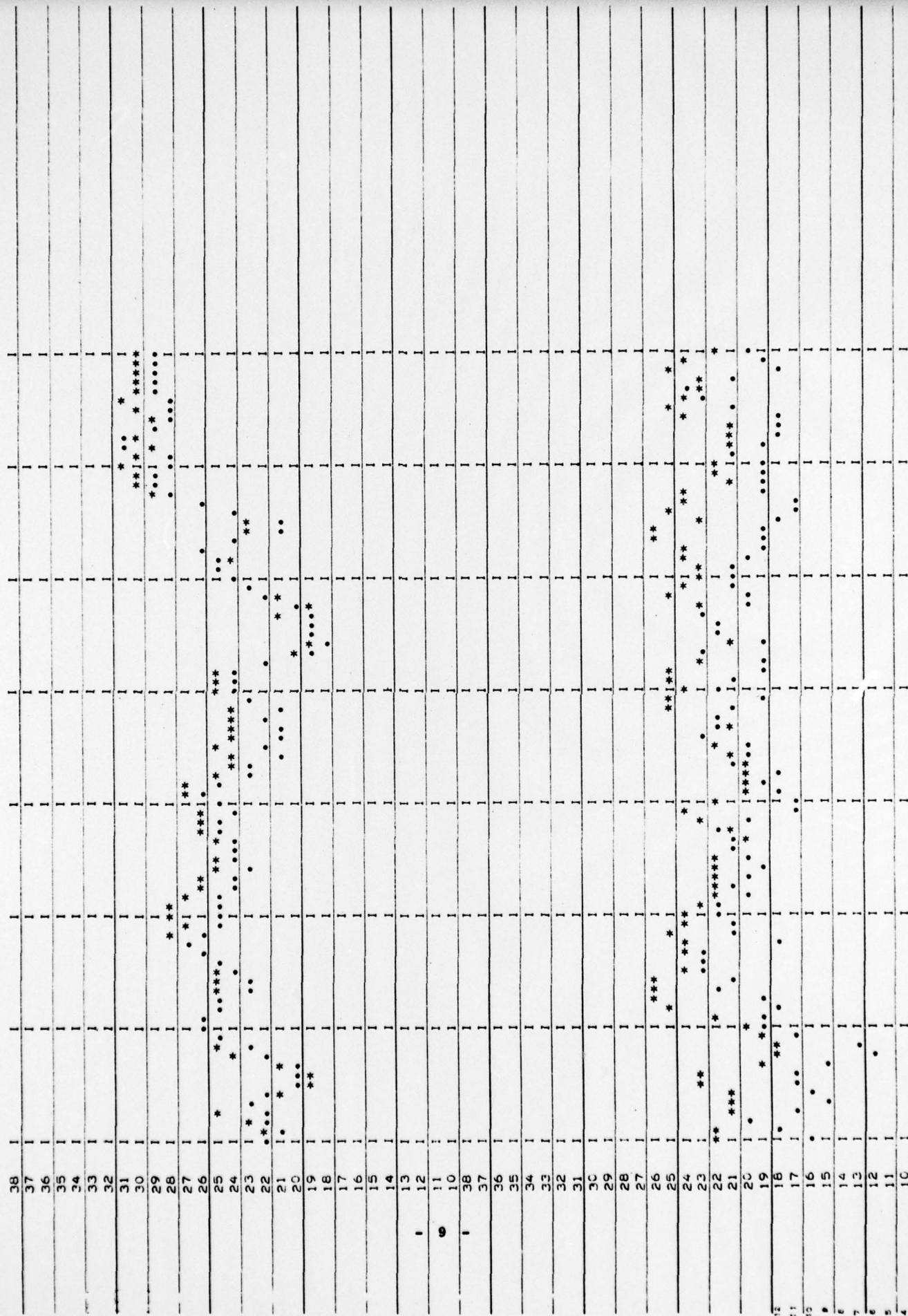


FIG. 3 - 85 POINTS PER GRAPH, GRAPH SEPARATED FROM Y VALUES. TWO SETS OF DATA PER GRAPH.

LISTING OF PROGRAM DECK

000001	0000	8 1000 53 0188	8 0000 40 0155	8 0001 40 0156	8 0410 40 0012	8 0410 40 0018
000001	0005	8 0410 40 0106	0 0000 48 0006	8 0000 13 0140	8 0410 40 0009	0 0000 01 0000
000001	0010	8 0000 38 0020	8 0000 42 0009	9 0000 10 0000	8 0000 44 0080	8 0000 30 0081
000001	0015	0 0001 48 0005	0 0000 16 0000	0 0 0 49 0005	9 0000 40 0000	8 0001 21 0012
000001	0020	8 1000 38 0022	8 0000 30 0036	8 0000 10 0156	8 0410 40 0029	8 0410 40 0035
000001	0025	8 0410 40 0101	8 9000 38 0036	0 0000 01 0000	8 0000 42 0009	9 0000 10 0000
000001	0030	8 0000 44 0080	8 0000 30 0081	0 0001 48 0005	0 0000 16 0000	0 0000 49 0005
000001	0035	9 0000 40 0000	8 2000 38 0048	8 0000 10 0141	8 0000 40 0149	8 0000 10 0142
000001	0040	8 4310 40 0129	8 0000 10 0143	8 4210 40 0122	8 4210 40 0123	8 4210 40 0126
000001	0045	8 4210 40 0127	8 0000 30 0069	0 0000 01 0000	8 0000 10 0156	0 0000 48 0007
000001	0050	8 0000 40 0157	8 0000 13 0140	8 0000 40 0149	8 3000 38 0056	8 0000 10 0157
000001	0055	8 0000 30 0057	8 0000 10 0149	8 0000 40 0158	0 0000 49 0006	8 4310 40 0129
000001	0060	8 0000 10 0158	8 0000 13 0144	0 0000 49 0006	8 4210 40 0122	8 4210 40 0126
000001	0065	8 0000 10 0144	0 0000 49 0006	8 4210 40 0123	8 4210 40 0127	8 1010 61 0243
000001	0070	8 0000 10 0150	8 0000 40 0148	8 0000 42 0189	8 0240 29 0220	8 5000 38 0000
000001	0075	8 4000 38 0245	8 1000 38 0100	8 0000 30 0105	0 0000 00	
000001	0080	0 0000 30 0000	8 0000 36 0080	8 0000 40 0099	8 0001 10 0099	8 0000 12 0097
000001	0085	8 0000 31 0087	0 0001 45 0000	0 0 2 45 0000	0 0001 48 0008	8 0000 12 0098
000001	0090	8 0000 40 0092	0 0001 45 0000		16 0000	8 0000 41 0099
000001	0095	0 0001 49 0000	8 0000 30 0080	0 5400 00 000	1 49 0001	0 0000 00

000001	0100	8 0000 42 0149	9 0000 10 0000	8 5610 18 0148	8 0000 35 0280	8 0001 21 0101
000001	0105	8 0000 42 0149	9 0000 10 0000	8 5610 18 0148	8 0000 35 0260	8 0001 21 0106
000001	0110	8 0000 10 0148	8 0000 12 0151	8 0000 40 0148	8 0000 18 0152	8 8000 38 0120
000001	0115	8 7000 38 0118	8 1000 61 0215	8 0000 30 0121	8 1000 61 0214	8 0000 30 0121
000001	0120	8 1000 61 0213	8 0000 34 0072	8 0400 26 0106	8 0400 26 0106	8 1000 38 0126
000001	0125	8 0000 30 0128	8 0400 26 0101	8 0400 26 0101	8 0000 42 0009	8 0000 21 0131
000001	0130	0 0000 00 1111	8 0412 40 0009	8 0000 30 0070	0 0000 0	
000001	0135	0 0000				
000001	0140	0 0000	1 0 0000 00 0119	0 0120 00 0000	0 060 00 0000	21
000001	0145	0 2000 00	6 0 0000 00 0 05	0 0000 00	0 0000 00	
000001	0150	0 0003 80 0000	1 0000 10 0000	0 0 0 90 0000	0 0303 03 0303	0 1414 14 1414
000001	0155	0 0000				
000001	0160	3 3333 33 3333	3 3333 33 3333	3 3333 33 3333	3 3333 33 3333	3 3333 33 3333
000001	0165	3 1111 11 1111	3 1111 11 1111	3 1111 11 1111	3 1111 11 1111	3 1111 11 1111
000001	0170	3 1111 11 1111	3 1111 11 1111	3 1111 11 1111	3 1111 11 1111	3 1111 11 1111
000001	0175	3 1111 11 1111	3 1111 11 1111	3 1111 11 1111	3 1111 11 1111	3 1111 11 1111
000001	0180	3 1111 11 1111	3 1111 11 1111	3 1111 11 1111	3 1111 11 1111	3 1111 11 1111
000001	0185	3 1111 11 1111	3 1111 11 1111	3 1111 11 1111	3 1111 11 1111	8 0000 00 0192
000001	0190	0 0000	8080 00 0			
000001	0195	0 0000				

